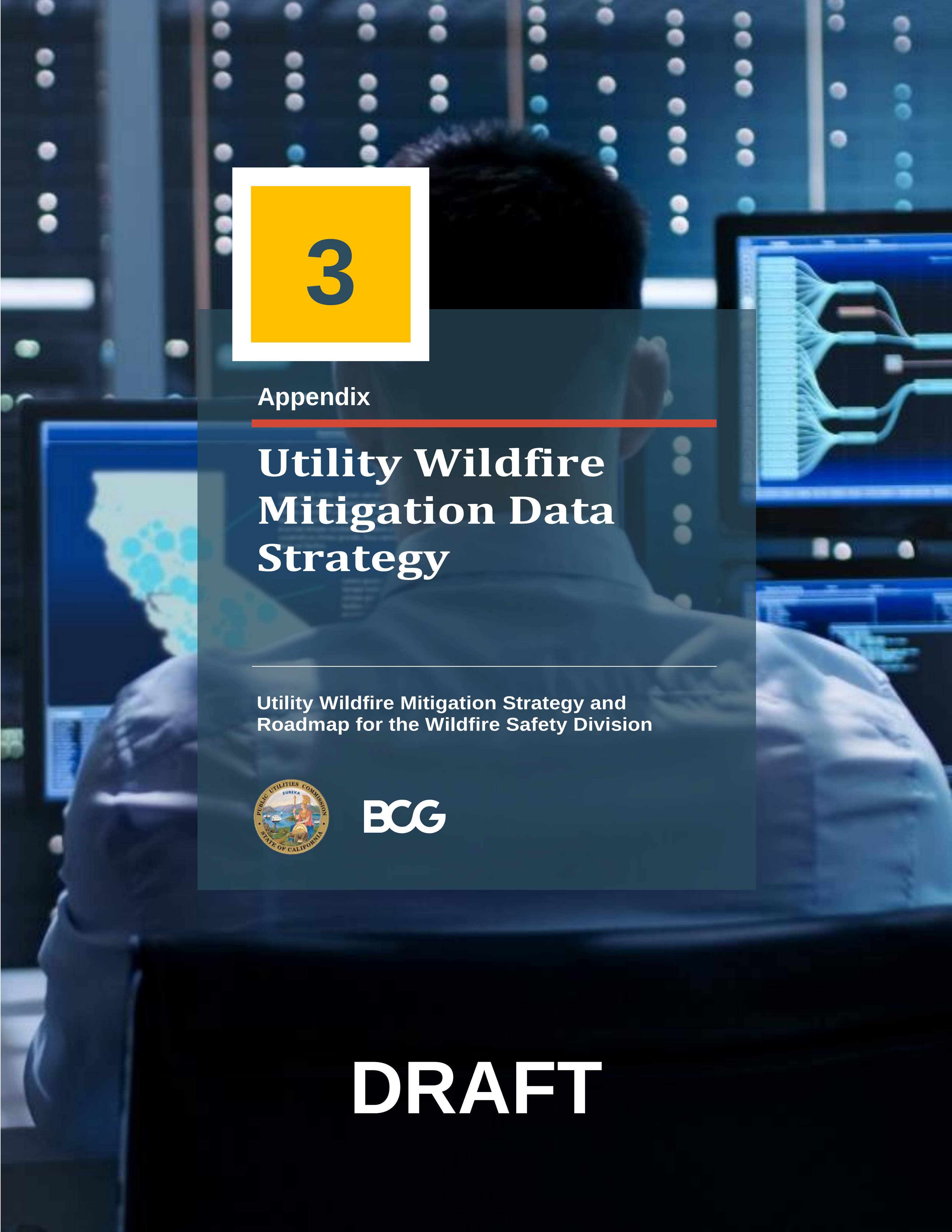


3

Appendix

Utility Wildfire Mitigation Data Strategy

Utility Wildfire Mitigation Strategy and Roadmap for the Wildfire Safety Division

BCG

DRAFT

Table of Contents

1 Introduction

1.1 Summary

Currently, the Wildfire Safety Division (WSD) within the California Public Utilities Commission (CPUC), and California's broader wildfire community, encounter a set of pain points that limit their ability to pursue long-term, utility-related wildfire risk management objectives. The pain points include:

- Poor data quality and limited availability
- Lack of process standardization across stakeholders
- Need for manual intervention in decision-making processes
- Lack of transparency
- Limited participation of relevant stakeholders

These pain points hamper a data-driven approach to utility wildfire risk management. Although many stakeholders are pursuing the use of data to better gauge and manage their risks, the lack of an overall strategy has meant that individual activities have taken place in silos, hindering implementation of statewide solutions.

WSD and its partners (such as CAL FIRE and Cal OES) can benefit from a robust and holistic data strategy in seeking to address existing pain points and more effectively manage utility-related wildfire risks for the State of California. The data strategy here would underpin the creation, maintenance, distribution, and operationalization of data across wildfire stakeholders, enabling data-supported decisions that are faster, more consistent, and more transparent.

The data strategy empowers the WSD to transcend today's manual reviews of utility wildfire mitigation plans, and to realize a digital future with decisions enabled by data and objective criteria. For example, the data strategy supports use cases, such as actively monitoring utilities' Public Safety Power Shutoffs (PSPS) mitigation activities by connecting field audit data with planned mitigation activities. Similarly, longer-term a properly implemented data strategy supports analyses of wildfire risk factors, enabling coordinated action across stakeholders. This data-driven decision-making will put the state at the cutting edge of the global fight against utility-related wildfires.

Pivotal to the data strategy is the build out of a data platform, a central repository and source of truth for key decision-driving data. The data platform can integrate data and qualitative inputs in a consistent manner from relevant stakeholders to power analyses and insights that drive utility wildfire mitigation and management decisions.

Implementation of the data strategy should occur in three phases. In the near-term (by the end of 2020), foundational elements of the data strategy will be operationalized, concurrent with any relevant immediate priorities like the 2020 WMP review process. In the medium-term (the next 6-9 months, following the conclusion of the near-term phase), a data platform supporting data collection, validation, archiving, and reporting is planned to be designed, built, and tested. The data platform can serve as a foundation for actions in the longer-term, where external data could be ingested by the WSD or its partners to enable predictive analytics and other enhanced use cases. At its maturity, the data strategy supports a broader implementation of more sophisticated analyses and engagement of a wider range of stakeholders.

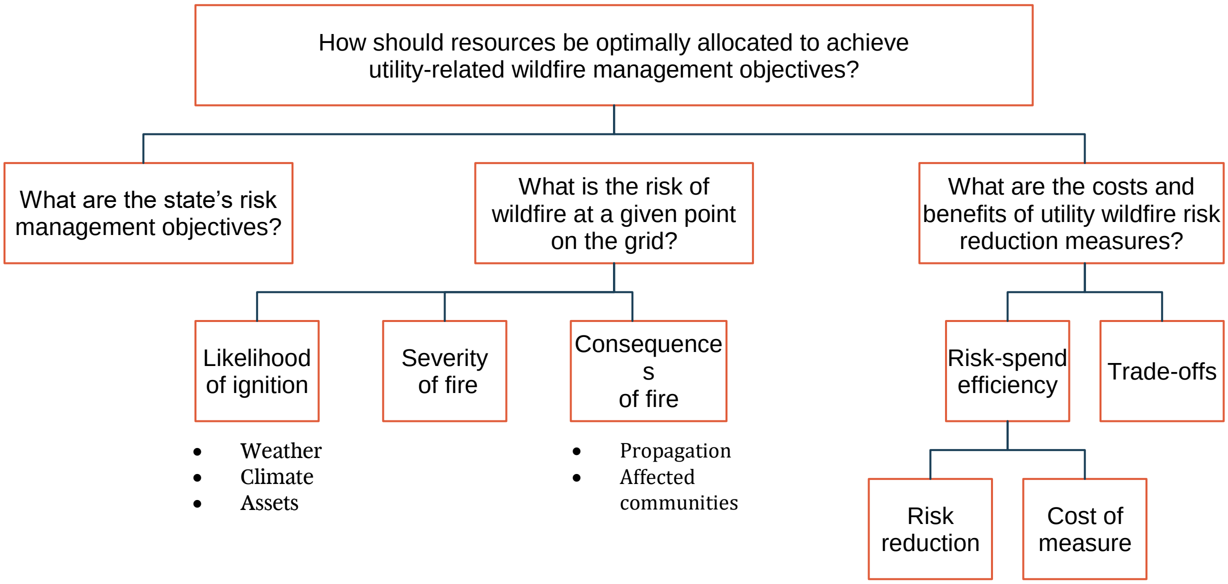
Operationalizing the data strategy requires investments in people, processes, and tools. Investment in people at the WSD, as well as partnerships with organizations such as CAL FIRE and Cal OES, or contracts with technically skilled organizations, provides the technical and managerial capability needed to build and maintain a digital data platform. New processes need to be established to appropriately govern data and its use. Similarly, new software tools are required to realize the analytical and reporting capabilities that would enable the WSD and its partners to effectively pursue the state's long-term utility wildfire risk management goals.

1.2 Current data strategy

Large, utility-related wildfires are a challenging risk to forecast and manage. They are low-frequency, high-consequence events typically resulting from extreme weather and operational conditions. The 'long-tail' nature of utility wildfire risk constrains statistical analysis, and the behavior of large, fast moving wildfires has proven difficult to forecast. The effects of wildfires are becoming more intense: in many fire-prone areas, wildfire seasons are growing longer and average wildfire sizes are increasing.

Utility wildfire mitigation efforts are often rooted in complex decisions that require detailed assessment of multiple risk factors. Figure 1 shows an illustrative decision tree for determining the optimal resource allocation for utility wildfire mitigation. Such a decision requires the quantification of the level of utility wildfire risk, combined with an assessment of cost and benefit implications of available risk mitigation measures. A foundation of rigorous data-driven analytics is required to enable decision-makers to make such determinations effectively and efficiently.

Figure 1: Illustrative decision tree for resource allocation to address utility-related wildfire risk



Historically, the CPUC has conducted its regulatory oversight using manual processes and static reporting products, resulting in oversight that is neither efficient nor sufficiently rigorous. Today, the WSD receives utilities' WMPs in different formats, requiring manual review by staff. The plans are typically made available in only PDF, and both the WSD and the public (which has the right to comment) lack access to interfaces or tools (e.g., GIS-enabled maps) that could make the plans easier to understand.

In response to the substantial increase in utility-related wildfire risk, individual stakeholders, including the utilities, have begun to adopt data-driven decision-making practices, including establishing collaborations that increase data capabilities. For example:

- In 2019, SCE pioneered the use of a Multi-Attribute Risk Score (MARS), which combined multiple drivers to quantify the relative severity of different risks (including wildfire), and applied it to estimate the impact and risk-spend efficiency (RSE) of potential risk mitigation measures, in a safety report to the CPUC.[1]

- In 2019, SDG&E launched proprietary software to quantify the risk of vegetation contact for each of its circuits, based on such data inputs as the counts of trees adjacent to the circuit's right-of-way by species and height, as well as a historical correlation with outages.[2]
- In 2019, some utilities, as part of their preparation for the WMPs, utilized private, third party wildfire propagation modeling to identify areas of high risk at more granular scales than the CPUC's High Fire Threat District (HFTD) maps.

However, these efforts have taken place in silos, with each major utility developing unique analytical tools tailored to their individual decision-making processes. The state does not have a data strategy focused on utility wildfire risk management, which could enable the WSD to conduct its regulatory oversight of utility wildfire mitigation activities in a data-driven manner. In pursuing wildfire risk management, utilities and the WSD have encountered five data-related pain points, specific symptoms that a data strategy would seek to address. These pain points are captured in Figure 2 below.

Figure 2: Current data-related pain points in today's WSD utility-related wildfire oversight process

1 Limited data quality	2 Lack of standardization	3 Decisions require manual intervention	4 Lack of transparency	5 Limited stakeholder participation
Data are not collected in the same manner, available with the same timeliness, or presented in a consistent manner, limiting their usefulness	Utilities use different diagnostic and prioritization approached as well as different data taxonomies for many variables, making it difficult to share and align on best practice	Many of the decisions are ultimately made by subject matter experts, and do not follow objective criteria	WSD has little visibility into the diagnostics and decision-making carried out by IOUs, as well as the data they utilize, as they prioritize their efforts	Utilities develop their plans mostly in isolation, with limited collaboration within IOUs and with other stakeholders

[1] Milestone for MARS calculation noted in: CPUC. *CPUC Review of SCE RAMP Report*. May 15, 2019. https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Risk_Assessment/SCE%20RAMP%20REVIEW%20Executive%20Summary%20-%205-15-2019.pdf; Usage in the context of risk reduction and RSE: SCE. *Southern California Edison's (U 338-E) Risk Assessment and Mitigation Phase Report*. November 15, 2018. http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/B2ADFEF6506791E9882583460074389A/$FILE/I.18-11-006%20SCE%202018%20RAMP%20Report.pdf.

[2] SDG&E. *Wildfire Mitigation*. September 17, 2019. https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/SDGE%20Wildfire%20Plan%20Update%20at%20the%20CPUC%209.17.19%20R1.pdf#page=12.

1. Limited data quality

Currently available wildfire and utility data are affected by four issues:

a. Data availability

The WSD does not automatically collect all of the data that it would need to monitor utility activities and outcomes. In the past, the CPUC has also not historically collected data on (or even established standardized definitions for) metrics including near-miss/near-hit[3] events, such as incipient faults, as part of its utility wildfire risk management oversight.[4]

b. Data accessibility

Historically, some data is provided in PDF or image form, requiring manual extraction to put them in a useable, accessible format. For example, the 2019 WMPs were filed as PDFs, with a document structure chosen by each utility. As a result, readers seeking the same data across were required to manually scan through each filing and transcribe the data.

c. Data consistency

Today, data is not consistently collected in a timely and standardized manner, limiting the accuracy of risk forecasts. For example, fuel moisture content, a key input to wildfire propagation models, is plagued by a lack of sampling guidelines, as well as an intermittence in the update cycle of the public database storing the data.

d. Data freshness

Lastly, some key data used for standard fire risk analysis is stale, relative to the time frame of the analyses for which they are used. For example, a commonly used map of fuel load[5] was last updated in 2016,[6] which means the map does not reflect the significant vegetation growth due to strong precipitation in water years 2017 and 2019.[7]

---

[3] The CPUC lacks a definition of 'near-miss or 'near-hit' in the utility wildfire context; c.f. for worker safety: "A near hit can be described as an incident that occurred and did not cause harm to a person…but could have resulted in injury." Source: NorthStar Consulting Group. *Assessment of Pacific Gas and Electric Corporations and Pacific Gas and Electric Company's Safety Culture*. May 8, 2017. https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/Risk_Assessment/PGE%20Final%20Safety%20Report%205-8-17%20NorthStar%20Consulting.pdf#page=254

[4] In its review of the 2019 WMPs, the CPUC noted that these metrics would be developed in Phase 2 (i.e. in June 2019, after 2019 WMPs were approved). Source: CPUC. *Guidance Decision on 2019 Wildfire Mitigation Plans Submitted Pursuant to Senate Bill 901*. June 3, 2019. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M296/K577/296577466.PDF#page=26. Damage to utility systems (which could constitute near-misses) after Public Safety Power Shut-offs are reported, but not in a standardized manner) c.f. PG&E, *PG&E's Public Safety Power Shutoff Oct. 23-25, 2019 Report*, November 8, 2019. https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/PGE%20Public%20Safety%20Power%20Shutoff%20Oct.%2023-25,%202019%20Report.pdf#page=5; SCE. *Amended PSPS Post Event Report Regarding Pro-Active De-Energization Event October 21 to October 26, 2019*. November 26, 2019. https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Amended%20SCE%20Post%20Event%20Reporting%20October%2021%20through%20October%2026,%202019.pdf#page=10.

[5] Fuel load is the density of biomass (which would become fuel for a fire) in a given location. Fuel load is reduced when a fire burns through the location or is reduced through intervention (e.g., thinning).

[6] The 2019-2020 update to the United States Department of Interior (DOI)'s LANDFIRE, LF Remap, is based on 2016 observations. Source: U.S. Department of the Interior. *LANDFIRE Remap (LF 2.0.0)*. https://www.landfire.gov/lf_remap.php.

[7] California Department of Water Resources. *Water Year 2017: What a Difference a Year Makes*. September 17, 2017. https://water.ca.gov/LegacyFiles/waterconditions/docs/2017/Water%20Year%202017.pdf; California Department of Water Resources. *Water Year 2020 Begins with Robust Reservoir Storage*. October 1, 2019. https://water.ca.gov/News/News-Releases/2019/October-19/Water-Year-2020-Begins-with-Robust-Reservoir-Storage.

2. Lack of standardization

Currently, stakeholders' data and diagnostics are not held to universal standards. In many instances, each stakeholder has its own methods and indices for utility wildfire risk assessment and planning, limiting the ability to make statewide comparisons and introducing opportunities for misalignment. For example, each of the major IOUs has their own individual Fire Potential Index (FPI), creating potential for confusion among the broader emergency operations community and general public. In addition, each utility has developed its own wildfire risk 'bow-tie' framework[8], shown in Figures 3a, 3b, and 3c. The lack of consistency between utilities, particularly on such a critical diagnostic, limits the WSD's ability to oversee the utilities' ability to conduct these types of calculations and to establish statewide standards.

3. Manual intervention required

Stakeholders' reliance on the manual interpretation of data by experts, currently affects diagnostics in three ways:

a. Subjectivity: Today, some diagnostics can only be produced based on determinations from experience. Prior WMP reviews, for example, required manual assessment by CPUC staff and other stakeholders, which was a labor-intensive process requiring the application of expertise in a range of subjects, including fire science, utility asset operations and maintenance, and risk management.

b. Inefficiencies: Some processes are prone to bottlenecks, such as an expert's bandwidth for reviewing data (especially across multiple simultaneous events or filings). Time-sensitive analyses are particularly prone to such constraints, for example assessing real-time wildfire risk often requires an analyst to simultaneously view many online data feeds from different weather and/or environmental monitoring agencies.

c. Access: Stakeholders' ability to benefit from diagnostics is often determined by the resources they have available in-house. For example, Fire Safe Councils or other community wildfire preparedness organizations do not have access to data on the type and location of fire risks, in order to prioritize their mitigation activities.

4. Lack of transparency

Many key utility-related wildfire decisions, particularly those by utilities affecting grid operations during periods of high fire risk, are not documented in a manner that allows for after-action review and auditing, particularly by third parties. This challenges the WSD's efforts to validate reasonableness and regulatory compliance of utility decisions.

5. Limited stakeholder participation

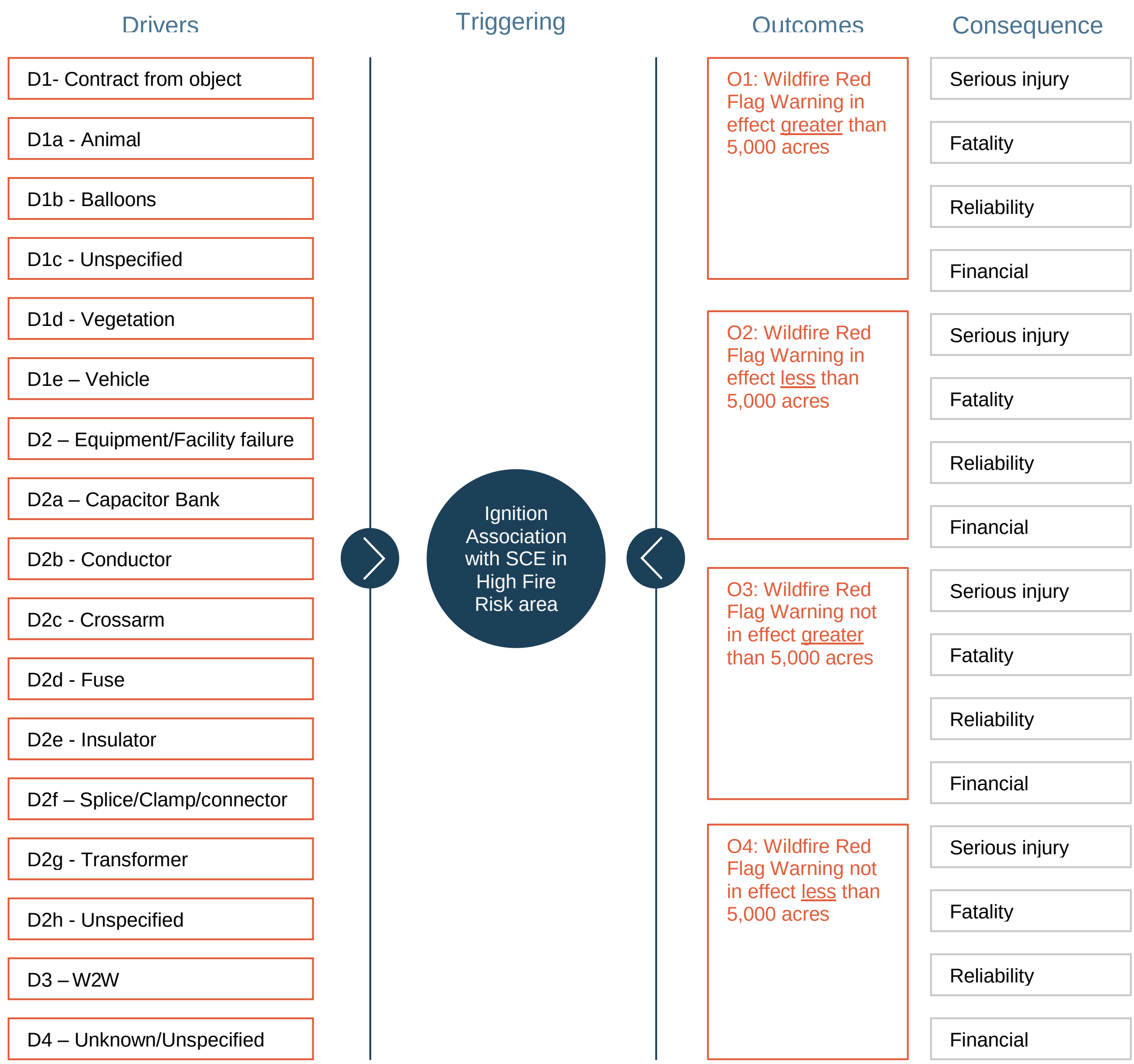
Currently, only stakeholders with substantial financial, human, and technical resources can participate in statewide utility wildfire risk management decision-making processes. Excluded from the process are important stakeholders such as local governments, Fire Safe Councils, and private landowners, due to the limited nature of their resources such as technical

---

[8] PG&E. *Amended 2019 Wildfire Safety Plan.* February 6, 2019; SCE. ***SCE's (U 902 E) Wildfire Mitigation Plan***. February 6, 2019; SDG&E. ***SDG&E's (U 902 E) Wildfire Mitigation Plan***. February 6, 2019. https://www.sdge.com/sites/default/files/regulatory/R.18-10-007%20SDG%26E%20Wildfire%20Mitigation%20Plan.pdf.

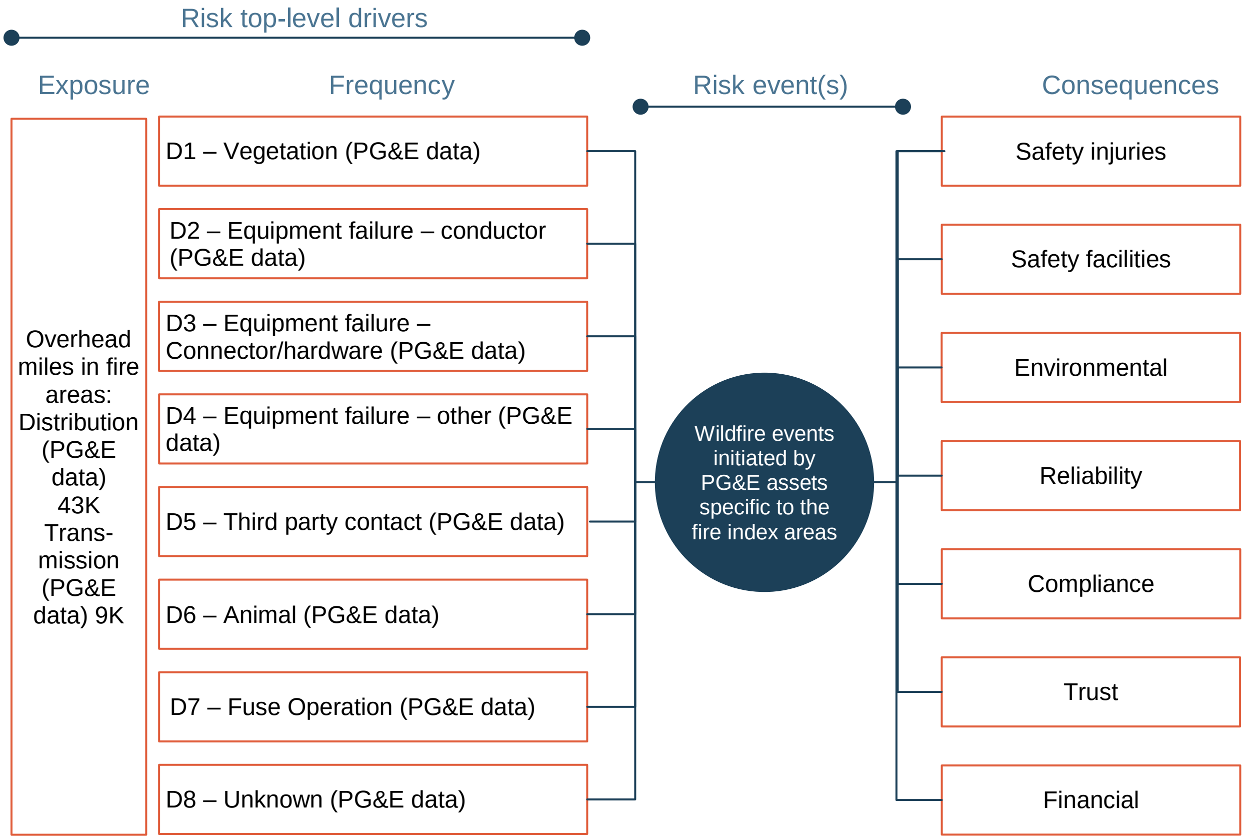
infrastructure, specialists on staff, and funding for studies and activities. The high barrier to accessing statewide wildfire data, and engaging in wildfire mitigation planning means that excluded stakeholders cannot contribute their unique resource – the local knowledge of critical infrastructure, as well as the trust and goodwill that can be important to implementing critical permitting, fuel management, and right-of-way maintenance projects.

Figure 3a: Southern California Edison wildfire risk bow-tie framework



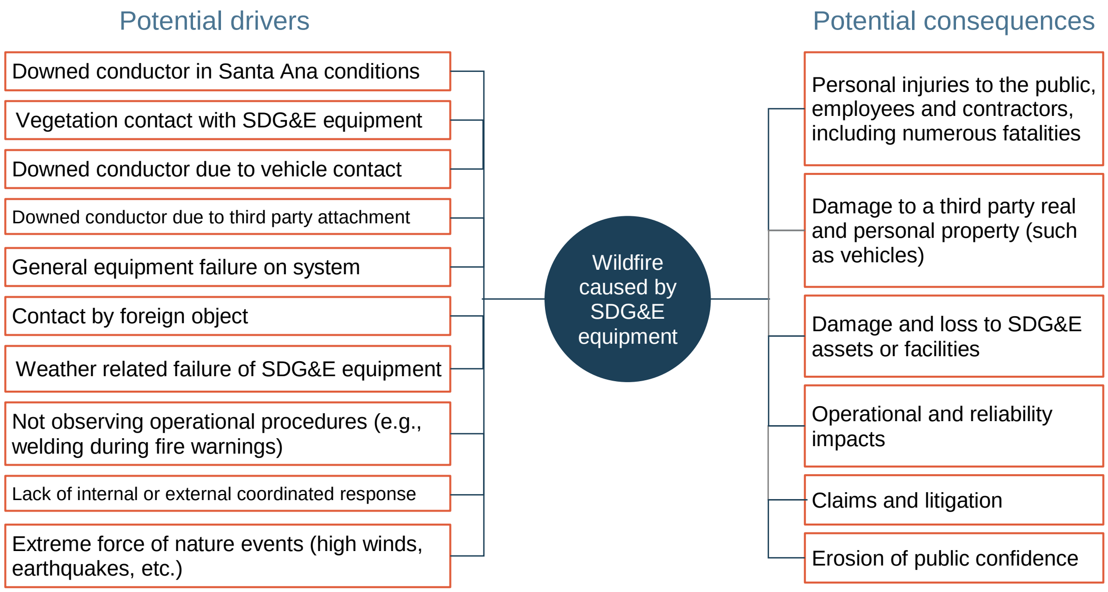
Source: 2019 Wildfire Mitigation Plans filed by SCE

Figure 3b: Pacific Gas and Electric wildfire risk bow-tie framework



Source: 2019 Wildfire Mitigation Plans filed by PG&E

Figure 3c: San Diego Gas and Electric wildfire risk bow-tie framework



Source: 2019 Wildfire Mitigation Plans filed by SDG&E

***

Beginning in 2020, the WSD will need to manage a greater volume and variety of data, conduct new diagnostics, and enable different outputs and insights to a wider range of stakeholders, relative to the 2019 WMP review. However, such requirements would likely challenge the capabilities of the WSD without the platform and tools necessary to standardize access to utility documents and to streamline the review process.

2 Recommendations

2.1 Importance of a data strategy

A robust data strategy is crucial for enabling the WSD to realize its longer-term vision for wildfire risk management. To this end, the purpose of the data strategy is not to simply digitize the WSD's record-keeping processes or to support its existing decision-making approach. Rather, the data strategy can transform the future robustness and scope of WSD decision-making. For example, by enabling the use of simulations that precisely estimate impact of risks and risk reduction measures in the longer term through external partnerships. Such a data-driven regulatory oversight process enables the WSD to more objectively scrutinize a larger volume of important utility decisions.

Beyond its oversight role, the WSD will also be positioned to better coordinate California utilities' wildfire mitigation activities. In the near- to mid-term, the data strategy enables a 'single source of truth' for California's utility wildfire-related data and insights. This allows state agencies (such as CAL FIRE and Cal OES) and utilities to share information with relevant stakeholders, identify synergies, and plan collaborative activities. In the long-term, the data strategy helps position California's wildfire mitigation community on the global stage, sharing innovative practices developed in-state, as well as importing ideas from other geographies that are also pursuing innovative data-driven wildfire mitigation solutions.

Ultimately, the data strategy provides the WSD, its partners, and utilities a foundation for integrating data across multiple sources and/or stakeholders, deploying the power of statistical forecasting techniques, and leveraging robust reporting tools to drive utility wildfire mitigation decisions. It helps drive a decision-making approach that is "impartial, fair, consistent, and transparent, maintains integrity at all levels, and adheres to the law,"[9] consistent with the broader CPUC's 2019 Strategic Directives.

2.2 Framework

The WSD's data strategy is developed around three areas of focus:

- Data vision, with four elements that articulate the WSD's ambition and values
- Four use cases, which characterize the WSD's evolving data requirements
- Four guiding principles, which guide the development and implementation of the data strategy

[9] CPUC. *Strategic Directives, Governance Process Policies, and Commission-Staff Linkage Policies*. February 20, 2019. https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Mission_and_Values/Strategic_Directives_and_Governance_Policies_Revised_February%2020%202019.pdf#page=15.

2.2.1 Data vision

The recommendations that follow are based on the proposed vision for the WSD's data strategy: "*to utilize the richness of data and possibilities of insights to make well-informed utility safety regulation decisions that are actionable, accessible, aligned, and auditable.*" This includes the following four elements:

1. Actionable: Designed to generate insights for key functions such as the WMP analysis, the PSPS analysis/audit, and driving actions for change at the IOUs
2. Accessible: Delivers relevant information to the right stakeholders, while ensuring confidentiality and data integrity
3. Aligned: Enables data sharing, prioritization of utility wildfire management action, benchmarking, and cross-stakeholder decision coordination
4. Auditable: Documents data sources and methodologies for key functions (e.g. WMP, PSPS, and IOU recommendations) such that they are available for review across relevant stakeholders

2.2.2 Use cases

Four use cases are envisioned to demonstrate the benefits of the data strategy and to serve as milestones for the WSD. These use cases are as shown in Figure 4.

Figure 4: Use cases to guide evolution of utility wildfire mitigation data strategy

Near-term	Mid-term	Longer-term

Near-term

1 **WMP Review: Preliminary**
- WSD reviews utilities' filings, as well as supporting data and documentation
  - Compliance with statutory guidelines (completeness check)
  - Level of organizational and technical maturity (forward-looking ambition, technical feasibility and effectiveness)
  - Record of activity, and of performance (resource use efficiency)

Mid-term

2 **Activity monitoring**
- WSD reviews utilities' activities and maturation against their WMPs, and evaluates whether the activities prescribed in the utilities' WMPs are achieving the expected outcomes.

3 **PSPS audit**
- WSD monitors PSPS mitigation activities and maturation against their WMPs

Longer-term

4 **WMP Review: Advanced**
- WSD will target to coordinate work with utilities to review their allocations of resources towards proactive wildfire mitigation measures, using advanced analytics to better inform most efficient and effective plans.

2.3 Guiding principles for development

To craft and implement a robust data strategy, reflective of the WSD's data vision and capable of delivering required use cases, the WSD must consider a set of guiding principles to govern its design and execution decisions. To that end, four guiding principles underpin WSD's data strategy:

1. Data as an asset: The data strategy must enable and support a mindset shift where data is treated as a key resource across all stakeholders. Such a mindset shift is critical to enable stakeholders involved in the process (including utilities, state agencies, and non-state collaborators) to adapt to new ways of working that maintain data cleanliness and accuracy.

2. Scalability: The data strategy must envision a long-term view throughout the design and implementation. A system design and implementation roadmap must be constructed such that initial investments lay the foundation for subsequent investments. As such, decisions that support system flexibility must be prioritized.

3. Holistic capability build: The implementation of the data strategy must contemplate comprehensive investments in people, processes, and tools necessary to support WSD's data vision and enable required capability.

4. Continuous improvement: The data strategy must support continuous improvements using an iterative process that allows for rapid development of Minimum Viable Products (MVPs), retrospectives and lookbacks to capture learnings, and improvements in the next iteration

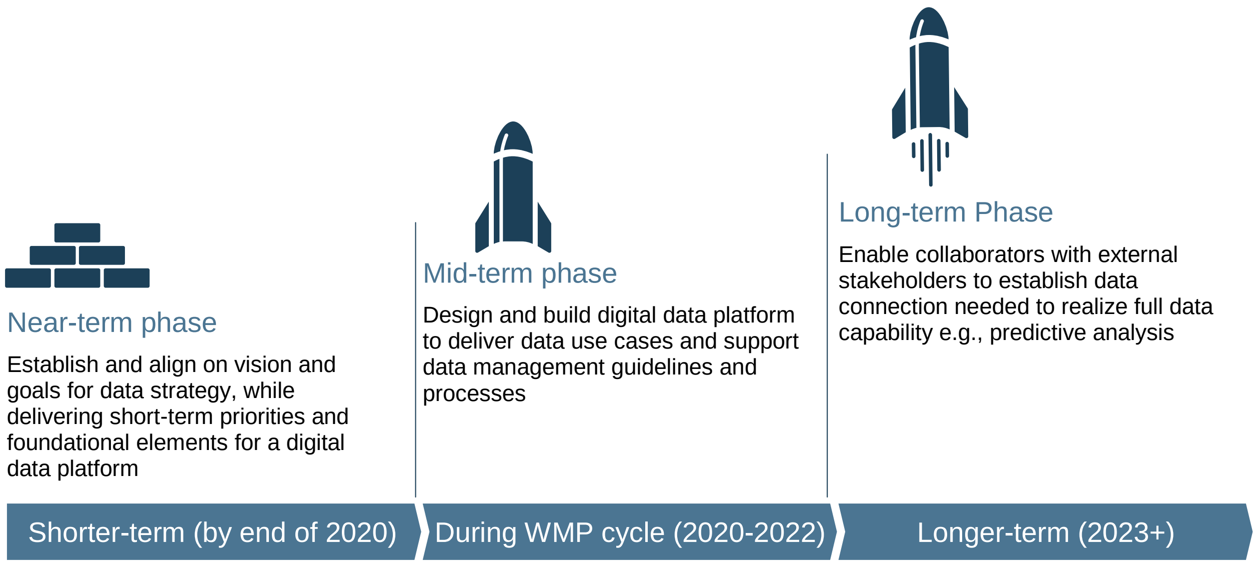
These guiding principles function as strategic "north stars," clarifying direction and enabling trade-offs in the event of conflicting priorities.

3 Data strategy & roadmap

Implementation of a robust, best-in-class data strategy is a gradual, multi-phased journey. Designing and executing a holistic data strategy often entails fundamental shift in existing ways of working, as well as significant resource commitments. Organizations embarking in such strategic digital transformations typically implement in a phased approach to allow adequate pace for sustained change.

Based on our experience, an organization of WSD's level of data maturity would require a three-phased implementation roadmap, sequenced over a timeline of 12-plus months, to fully implement a robust data strategy. Figure 5 below shows the three distinct phases (i.e., near-, mid-, and long-term phases) as well as the high-level timeline for each phase.

Figure 5: High-level roadmap for data strategy development and execution



In the near-term phase, investments focused on addressing immediate needs and installing key foundational elements are prioritized. The mid-term phase plans to focus on designing and building out a digital data platform, the central backbone structure that will power data use cases and support newly established data management process. Finally, the long-term phase aims to establish connections and collaborations necessary to enable next-gen data capabilities.

These phases are sequenced to develop WSD's data capability in an agile fashion[10] while delivering to operationally mandated timelines. A near-term phase builds the foundation for future data investments while simultaneously driving critical short-term deliverables required to support the 2020 WMP process. Subsequently, a mid-term phase is planned to culminate in a robust digital data platform in time to drive monitoring and review use cases. Ultimately, the long-term phase aims to build on top of preceding phases to incrementally deliver full capability processes and systems that supports WSD's data vision and uses cases. Each phase requires investments in people, processes, and tools, described in detail in the following sections.

3.1 Near-term action plan

3.1.1 Recommended actions

The primary focus of the near-term phase is to support the WSD for collection, processing, and review of 2020 WMPs and setting the groundwork for a digital data platform to be built out in a subsequent phase. The combination of these immediate-term priorities, as well as foundational elements, constitute the recommended actions for the near-term phase.

[10] Agile is a method of product development focused on cross-functional collaboration, iteration on functional versions of the software, and a focus on customer satisfaction. See: Agile Alliance. "12 Principles Behind the Agile Manifesto." https://www.agilealliance.org/agile101/12-principles-behind-the-agile-manifesto/.

Executing the near-term phase of the data strategy requires investments in people, processes and tools. These investments are described below and laid out in Figure 6.

1. **Investment in <u>people</u>**
Includes addition of key resources and teams required to acquire necessary data skills

2. **Investment in <u>processes</u>**
Comprises of modifications in existing processes, and the stand-up of new ones to enable delivery of critical use cases

3. **Investment in <u>tools</u>**
Requires procurement of technology components needed to power established use cases

Figure 6: Recommended actions for near-term phase of data strategy implementation

Investment in people	Investment in process	Investment in tools
1 Develop data governance playbooks to provide standards for data sharing across state agencies and associated partners	4 Applying relevant statewide data security protocols against relevant sections of repository hierarchy	7 Establishment and standardization of templates for collecting utility wildfire management plans, data, and initiatives
2 Hire additional staff with necessary technical capabilities to clean data submitted through the WMP process and	5 Build out of data dictionary that drives clarity and uniformity in information requirements / submissions	8 Securing of file repository to enforce standardized structure for information storage and sharing across stakeholders
3 Align on data governance model and individuals responsible for collaboratively determining rules for data sharing across WSD's data platform between WSD and affiliates.	6 Development of data taxonomy to codify collected information into structured, easy-to-navigate hierarchy.	

<u>Primary focus</u>: To be complete by end of 2020

<u>Secondary focus</u>: Lay the groundwork for a fully digital platform

3.1.2 Key tactical elements of near-term implementation plan

Figure 7 lays out four tactical elements to be executed for a successful implementation of the near-term data strategy. These implementation considerations are described in detail below.

Figure 7: Tactical elements of the near-term data strategy implementation

1 Data taxonomy & dictionary

Taxonomy organizes information, and dictionary provides definition & context

2 Data collection templates

Templates provide consistency between utilities, and among data points

3 Security protocols

Established protocols ensure that the right information gets to right stakeholder

4 Playbook/ User guide

'Playbook' will guide all engagement with platform

1. Data taxonomy and dictionary

A data taxonomy is a logical structure that for cataloging the data and information needed to drive utility wildfire mitigation use cases in a manner that allows for easy access and comprehension. An example of data taxonomy for codifying information received as part of utility submittal of the ignition reporting template is shown in Figure 8. Despite still supporting a manual process in the near term, such a structure framework for codifying data allows for easy access and objective comparison of plans across utilities.

Figure 8: Illustrative categories from draft proposed ignition reporting template

Company	Event information	Outage info	Field observations	Situational awareness	Fire specifics	Outcome
Utility name	Latitude/longitude	Outage reported?	Suspected initiating event	Last inspection date	Total area burned	Fatalities
Facility ID	Date/Time	Outage date/time	Equipment failure	Time-to-failure inspection	Suppressed by	Role of victim
Equipment involved	Ignition or near miss	Outage duration	Contact from object	Load history	Suppressing agency	Value of assets destroyed
Equipment type	Material at origin		Contributing factor	Wind speed at time/location of event		Structures destroyed
Voltage	Land use at origin			Temperature at time/location of event		People displaced
						Acreage burned

The data taxonomy will serve as the initial blueprint for the WSD's data model to be built out in the mid-term. The data taxonomy also enables development of the data dictionary by functioning as a backbone that structures and unifies data and information from multiple disparate sources.

The data dictionary documents and defines metadata associated with a data point, along with a codified structure in the data taxonomy, allowing users to understand the purpose, source, lineage, and any cleaning or calibration that has been applied to a data point. By establishing common nomenclature across stakeholders, the dictionary sets a foundation for standardization and uniformity in the WMPs' preparation, review, and post-approval monitoring.

The WSD will play a central role in the development of the data taxonomy and data dictionary documents, in consultation with a broader set of stakeholders to ensure a cross-stakeholder lens.

2. Data collection templates

Templates, such as those illustrated in Figure 9 below, will be used to ensure that the utilities submit information consistently and comprehensively. They were developed in the initial phase of the 2020 WMP process and were subject to public comments. The data collection template will enforce rigor and structure in how utility submissions are organized and reviewed.

Figure 9: Recent performance on progress metrics, last 5 years (WMP Guidelines, Table 1, partial)

#	Progress metric name	Annual performance					Unit(s)
		2015	2016	2017	2018	2019	
1	Grid condition findings from inspection						Number of Level 1, 2, and 3 findings per mile of circuit in HFTD, and per total miles of circuit for each of the following inspection types: 1. Patrol inspections 2. Detailed inspections 3. Other inspection types
2	Vegetation clearance findings from inspection						Percentage of right-of-way with noncompliant clearance based on applicable rules and regulations at the time of inspection, as a percentage of all right-of-way inspected

3. Security protocols

The design and implementation of the near-term file repository must contemplate information access, user authentication, and other necessary security features. While all the 2020 WMP filings and support documentation will be made public, a security system will be needed for confidential utility information. Including protocols in this initial data system will demonstrate the WSD's commitment to appropriate and secure data handling to utility and non-utility stakeholders.

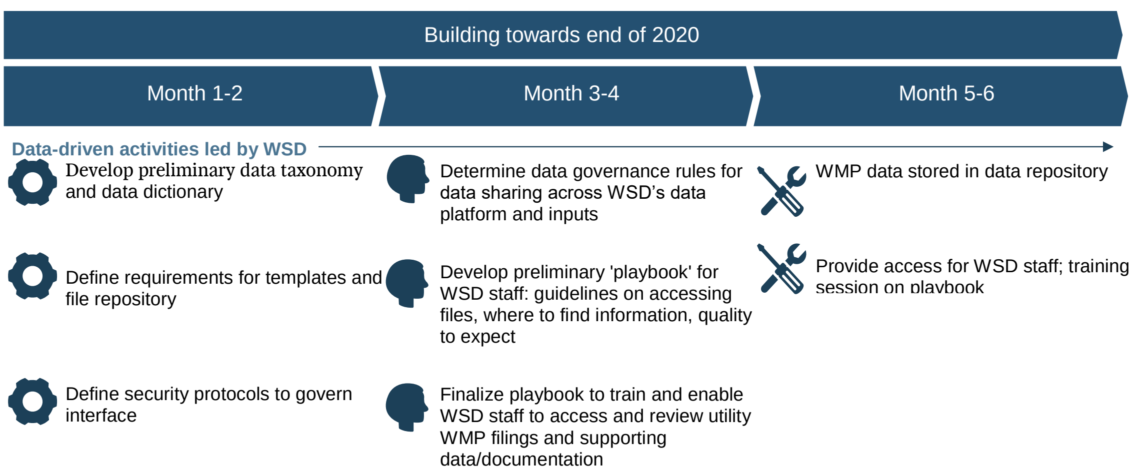
4. Playbook

A guide to the system, processes, and tools is necessary to lower the barrier to understanding the system's function. A 2020 WMP data governance playbook provides detail to the standards for data sharing in order to support stakeholders in running diagnostics and generating the insights needed to make decisions. The initial target audience will be the WSD personnel involved in the WMP review process as well as CAL FIRE and Cal OES resources as makes sense, but the playbook could potentially be expanded in content and audience as the scope and maturity of the data strategy evolves.

3.1.3 Implementation timeline

As shown in Figure 10, in order to support the 2020 WMP review process, the WSD will need to act quickly, establishing the basic foundations of a data strategy early on. Once in place, the processes and tools developed can be utilized to orchestrate the process needed to administer the 2020 review. Given the brief timeline, a sophisticated data platform will not be possible to develop. The collection, storage, and processing of utility submission will necessarily still be manual at this stage of the data strategy. However, foundational investments made in this stage will allow the WSD to meet its set timeline while setting the commission up to embark on fully building the required digital data platform.

Figure 10: Timeline to implement near-term phase of data strategy



3.1.4 Near-term use case

2020 Wildfire Mitigation Plan evaluation

The near-term use case to initialize the implementation of WSD's data strategy is targeted to be an initial review of utilities' 2020 WMPs. In 2020 the WSD is requiring substantially different filings than the CPUC did in 2019. Whereas previously utilities could primarily submit only narratives, they are now required to respond to surveys, provide detailed data in spreadsheet and GIS formats, and outline their compliance with such regulations as GO 95. The WSD is now reviewing each of these using maturity models and statutory requirements.

The 2020 review comprises four stages:

1. **WSD published templates and other related materials for the WMP**

This was a manual process: the WSD displayed the draft WMP guidelines online on December 16, 2019 and received electronically filed comments from stakeholders by January 7, 2020.[11] Materials included the WMP guidelines, the utility wildfire mitigation maturity model, a utility survey, proposed WMP metrics, and a Supplemental Data Request (SDR).[12]

2. Utilities completing and submitting their WMP and SDR responses

This is largely a manual process: beyond filing written plans, the utilities were required to complete a survey and supply supporting data. The utilities are required to complete an electronic utility survey and upload documents using a standardized file naming convention, expediting reviewers' access to the same information across all utilities.

3. WSD's statutory compliance check of the WMP

This is a manual process, in which WSD staff check the written responses against a set of completeness guidelines.

4. WSD's evaluation of the WMP

Determine whether the WSD should approve the utility WMP given provided information. Figures 11a and 11b below organize the stages described above, showing how stakeholders interact, when key diagnostics are made, and, ultimately, the WSD arrives at a decision. Figure 12 describes how the WSD's information gathering process will drive diagnostics for the 2020 WMP review process.

The 2020 review provides three main benefits beyond the immediate decision for the WMP:

- First, the WMP itself will be used by utilities as a prerequisite to receive a Safety Certificate.

- Second, outcomes of the WMP approval process will support medium-term and long-term oversight. In the medium-term, the WSD plans to evaluate whether utilities are undertaking the activities promised in their WMP. In the long-term, WSD will be able to use the outcomes (in terms of wildfire risk reduction) realized by utility wildfire mitigation activities to inform more advanced evaluation WMP effectiveness in the future.

- Lastly, the more data-driven evaluation of the WMPs will enable the WSD to make more comprehensive comparisons between utilities, differentiating the leaders and laggards by category, and driving insights into utility wildfire mitigation and management practices that underpin superior reduction and/or management of wildfire risk among leaders. The WSD can also review the cohort of utilities, in order to identify industry-wide resource gaps and/or opportunities for collaboration.

In order to complete these stages, the WSD will review the 2020 WMP materials in an accessible format, assess relevant metrics (e.g., maturity model scoring), and view the results.

---

[11] Rulings and templates are available at www.cpuc.ca.gov/SB901

[12] The SDR outlines a broader set of data that the CPUC is requesting from utilities and intends to formalize in the 2021 process to evaluate utility plans, activities, and outcomes in greater detail.

Stakeholders' reviews will benefit from consistency in data definitions (e.g., through using the same ignition reporting template), format (e.g., following a standardized template), and criteria for plans. While the review process will remain largely manual, and rely upon the judgment of the reviewer, templates and scorecards will highlight the benefits of a data-driven regulatory review.

Figure 11a: Illustrative process flow for 2020 WMP review by the WSD (Steps 1-3)

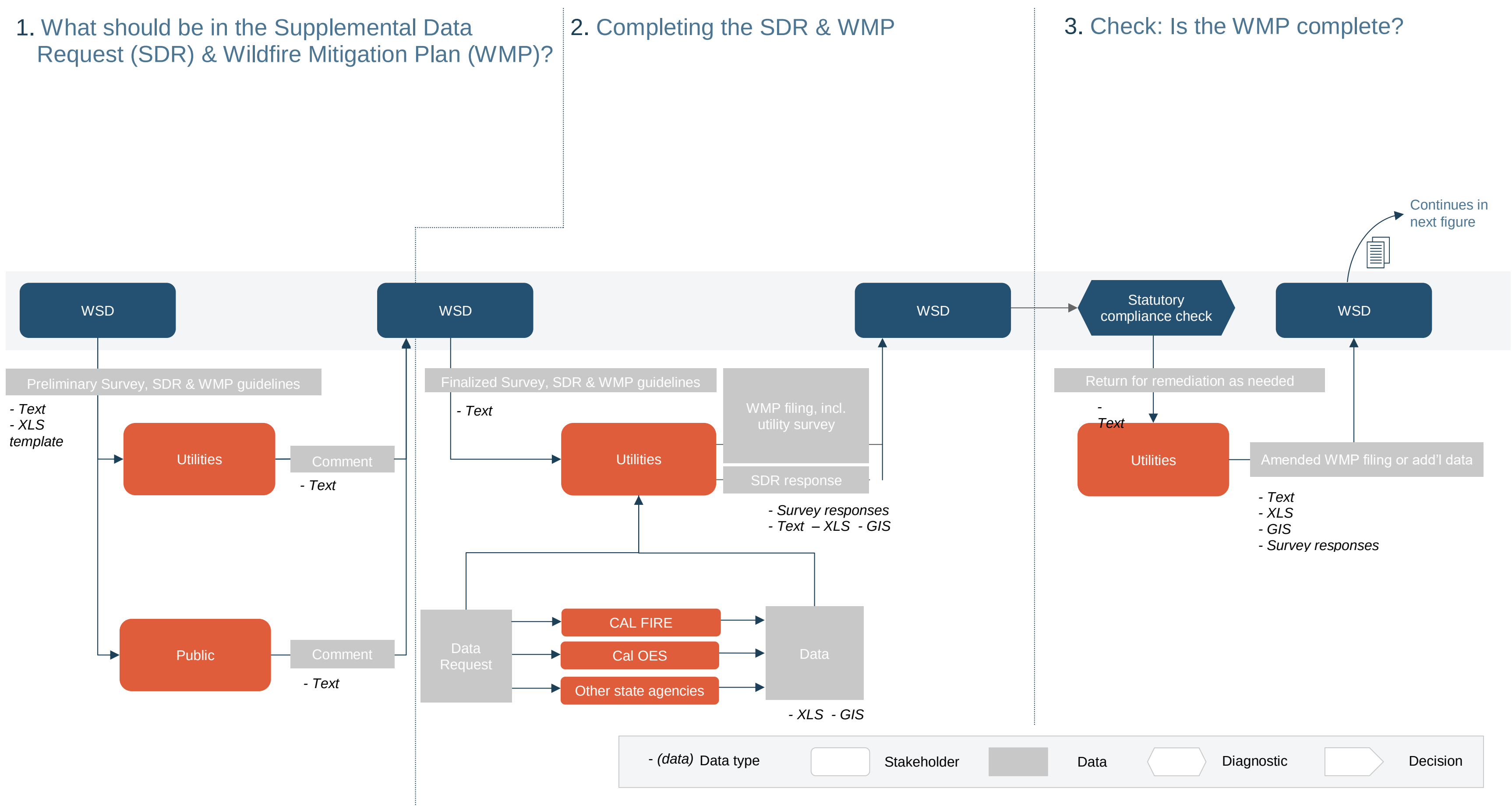


Figure 11b: Illustrative process flow for 2020 WMP review by the WSD (Step 4)

4. WMP Review

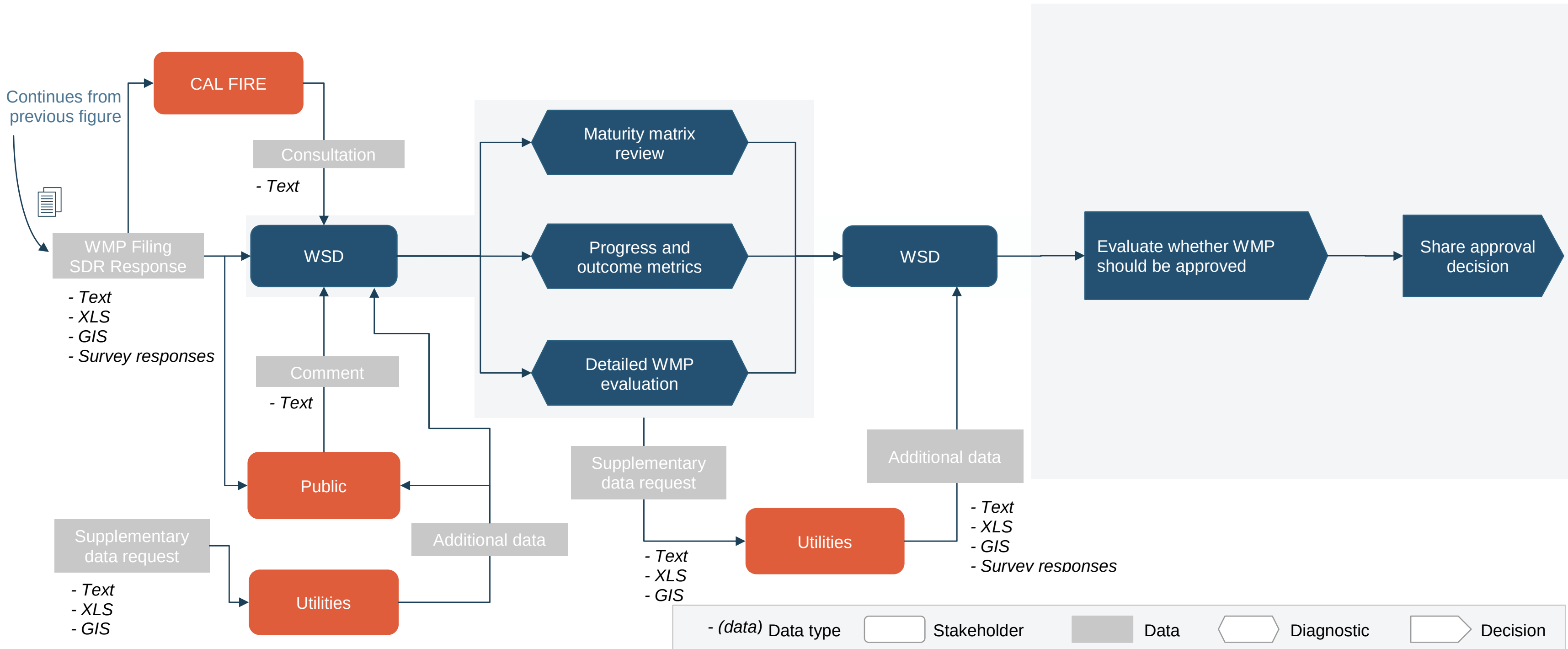


Figure 12: Illustrative data flow for 2020 WMP review by the WSD

Data → Insight

Diagnostics	Data sources	Data ingestion	Data repository	Analytics	Reporting
Maturity matrix review	Maturity model documentation: • Text • XLS • GIS Utility survey responses WSD maturity scorecard	• Data converted into consistent format (e.g., GIS data) • Metadata required to identify each data point • Data validation • Data quality check	• Stored in a structured manner to allow retrieval and comparison (e.g., across utilities, annual review against WMP targets) at a later date	Compare WMP against WSD targets: • Are WMP proposals appropriate to address level of risk identified? • Will WMP put the utility on a path to reduce wildfire risk?	Provide WSD decision-makers with insight to make decisions regarding utility's WMP: • Approve • Conditionally approve • Do not approve
Progress metrics and outcome metrics	Metrics and outcome reporting template and documentation: • Text • XLS			• Establish baseline for future reviews	
Statutory compliance review	Statutory compliance documentation: • Text			• Is the WMP compliant with WSD	

3.2 Mid-term action plan

3.2.1 Recommended actions

The currently planned central focus of the mid-term phase will be the designing, building, testing, and deploying of a digital data platform to support the WSD's utility wildfire management oversight functions. To implement a best-in-class data platform, investments in people, process, and tools will be required, building on the investments in the near-term phase, while also laying ground work to leverage advanced data capabilities (e.g., predictive analytics) developed by utilities, researchers, technology companies, and other.

Recommended mid-term actions across the different investment buckets described below in Figure 13.

Figure 13: Recommended actions for mid-term phase of data strategy implementation

Investment in people	Investment in process	Investment in tools
1 Engage program management team to oversee end-to-end platform build and test and associated change management effort.	3 Continue build of data taxonomy down to data element level as well as iterative build out of data dictionary	5 Procure software components required to build out the platform based on platform design architecture
2 Engage platform implementation team to stitch together the key software components.	4 Design data platform architecture that harvests information from disparate information sources into a centralized repository to power WSD use cases	6 Develop front-end data acquisition tools to digitally obtain data from across all relevant stakeholders

Standing up a program management team is a crucial first step to support requirement gathering and detailed definition of critical use cases. Additionally, such a team helps ensure optimal platform architecture is developed at the get-go, avoiding potential downstream misalignment and/or need for rework. In contrast, platform implementation resources can be contracted and brought onboard once use case definition, requirement gathering, and platform design are completed. This should all be done while leveraging existing current WSD GIS capabilities to build on existing infrastructure.

3.2.2 Key tactical elements of mid-term implementation plan

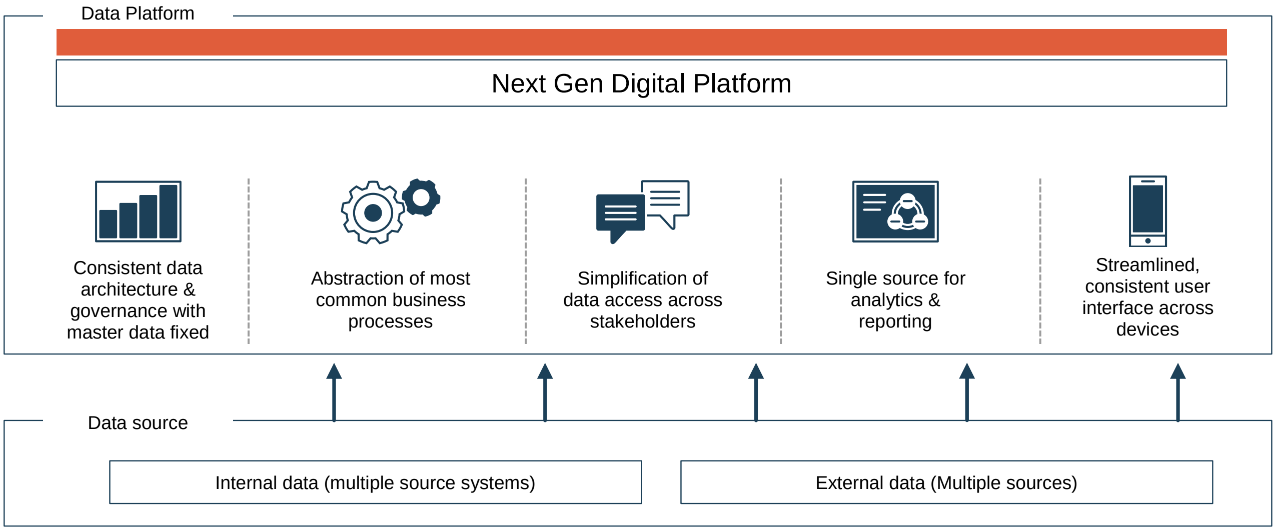
This section lays out a set of three tactical considerations for building a robust data platform and actualize the WSD's data strategy ambitions. These considerations include:

1. Key outcomes enabled by a data platform
2. Technology design configuration for a best in class platform
3. Required technical resources for build and maintain phases

These considerations are discussed in detail below.

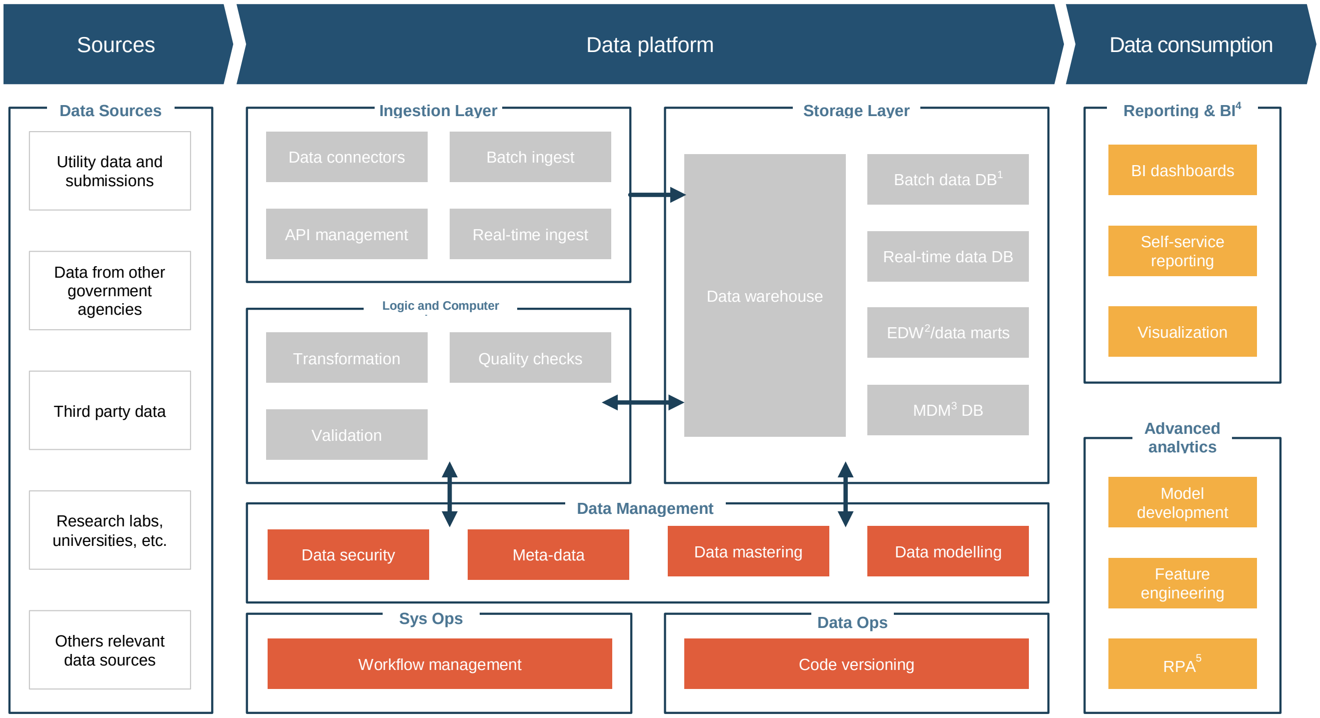
1. **Key outcomes enabled by a data platform**.
   As shown in Figure 14, a data platform ingests data from multiple internal and external sources and delivers five outcomes. These outcomes directly tie to the data vision that the WSD data strategy is pursuing.

Figure 14: Key imperatives of a data platform



2. **Technology design configuration for a best-in-class platform**.
A robust data platform typically consists of multiple technology tools stitched together to deliver the desired digital use cases. Figure 15 lays out an example configuration of a best-in-class data platform. Integration of the multiple constituent parts of a data platform require specific technical resources, typically sourced from specialized external vendors to support rapid buildout. Build activities must be tightly coordinated with requirements from business stakeholders to ensure alignment of platform build with business outcomes.

Figure 15: Example configuration of a next-gen platform



1. Database 2. Electronic data warehouse 3. Master data management 4. Business intelligence 5. Robotic process automation

3. Required technical resources for ongoing maintenance phase.

Beyond platform building by an external vendor implementation team, ongoing maintenance of a data platform requires a specific set of technical resources that must be procured externally or retained in-house. Required technical skills largely depend on the platform architecture but generally fall under the roles described in Figure 16. Identification, hiring, and onboarding of required resources (full-time employees) at the appropriate stage of platform implementation allows for appropriate overlap between build and maintenance teams, driving better knowledge transfer.

Figure 16: General technical skillsets required to build and maintain a data platform

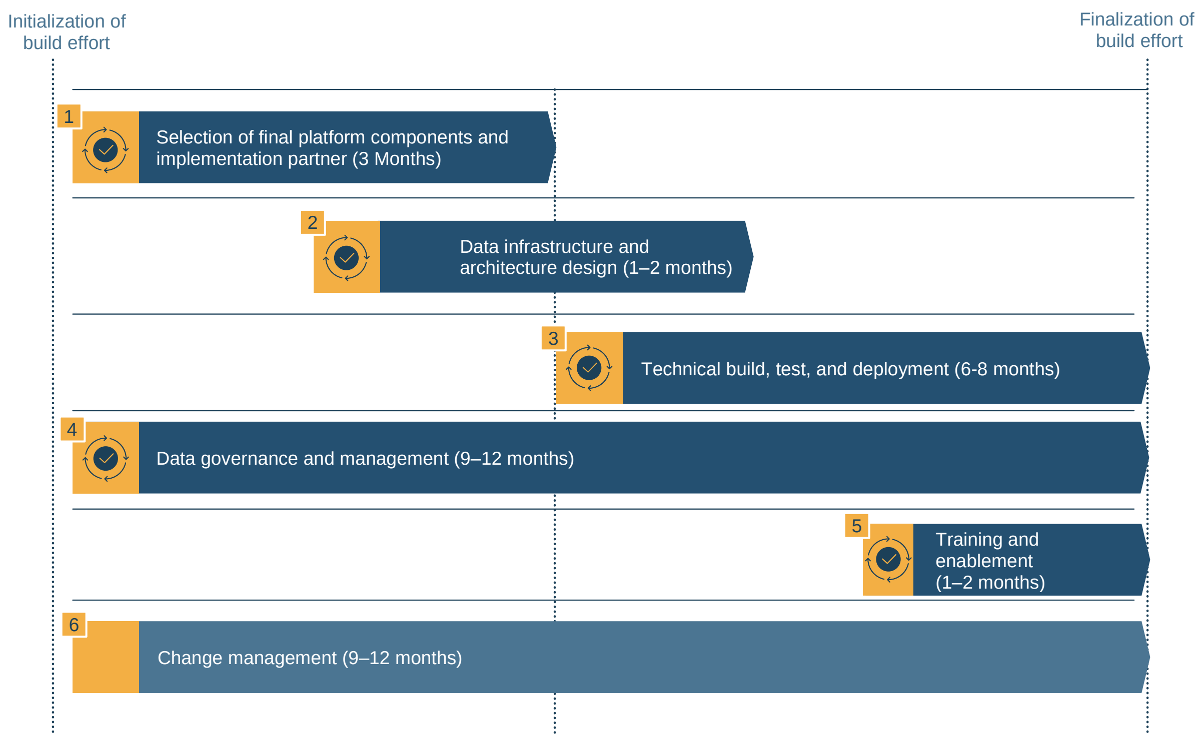
Example roles	Responsibilities
Data Architect	Overall oversight of meeting business needs via platform, including leading data model, building and connecting core systems to platform
Data Engineer	Develop and test data platform and pipelines, assemble complex data sets and build infrastructure and processes for Extract, Transform, Load (ETL)[13] and data model
Cloud Engineer	Build cloud infrastructure to ensure data security and availability
ETL Developer	Write code for ETL of individual sources under the guidance of the data architect and the engineer
BI Developer	Write initial Business Intelligence (BI)[14] reports to deliver initial wins based on business requirements and direction of data architect

[13] Extract, transform, load (ETL) describes the process in which data are taken from the source's system, translated into the format used by the destination (recipient) system, and loaded into the latter's system. Source: SAS Institute Inc. "ETL: What it is and why it matters." https://www.sas.com/en_us/insights/data-management/what-is-etl.html.
[14] Business intelligence (BI) leverages software and services to transform data into actionable insights that inform an organization's strategic and tactical business decisions. Source: Pratt, Mary K. & Fruhlinger, Josh. "What is business

3.2.3 Implementation timeline

Building out a data platform entails execution of five interconnected workstreams involving multiple business and technical stakeholders. As shown in Figure 17, a concerted 9-12 month effort is required for full end-to-end implementation. Executing such a complex program and requiring tight process coordination between business and technical teams requires a dedicated central program management team. Therefore, establishing a program management team that is tasked with overall program oversight and coordination of the different activities within and across workstreams is a crucial ingredient for successful platform implementation.

Figure 17: High-level data platform implementation roadmap



3.2.4 Mid-term use case

Mid-term use case: Utility activity monitoring

Upon approval of the 2020 WMPs, utilities will begin executing them through targeted activities (e.g., enhanced vegetation removal) and investments (e.g., in asset hardening). The WSD plans to monitor the utilities' implementation, based on the process laid out in Figure 18, reviewing both the extent and nature of their resource allocations relative to approved plans.

---

intelligence? Transforming data into business insights." *CIO*, October 16, 2019. https://www.cio.com/article/2439504/business-intelligence-definition-and-solutions.html.

In particular, the WSD aims to conduct four diagnostics:

1. Are the utilities complying with statutory requirements?

   This diagnostic is likely mostly manual, focused on reviewing utility policies and plans to ensure that they follow broader industry standards (e.g., worker safety).

2. Are the utilities successfully executing on the activities promised in their WMPs, at the pace that they promised?

   This diagnostic will ideally be largely data-driven: following WMP approvals, the WSD aims to create a dashboard listing planned activities, side-by-side with actual results retrieved from utility systems.

3. Are the utilities maturing according to plans?

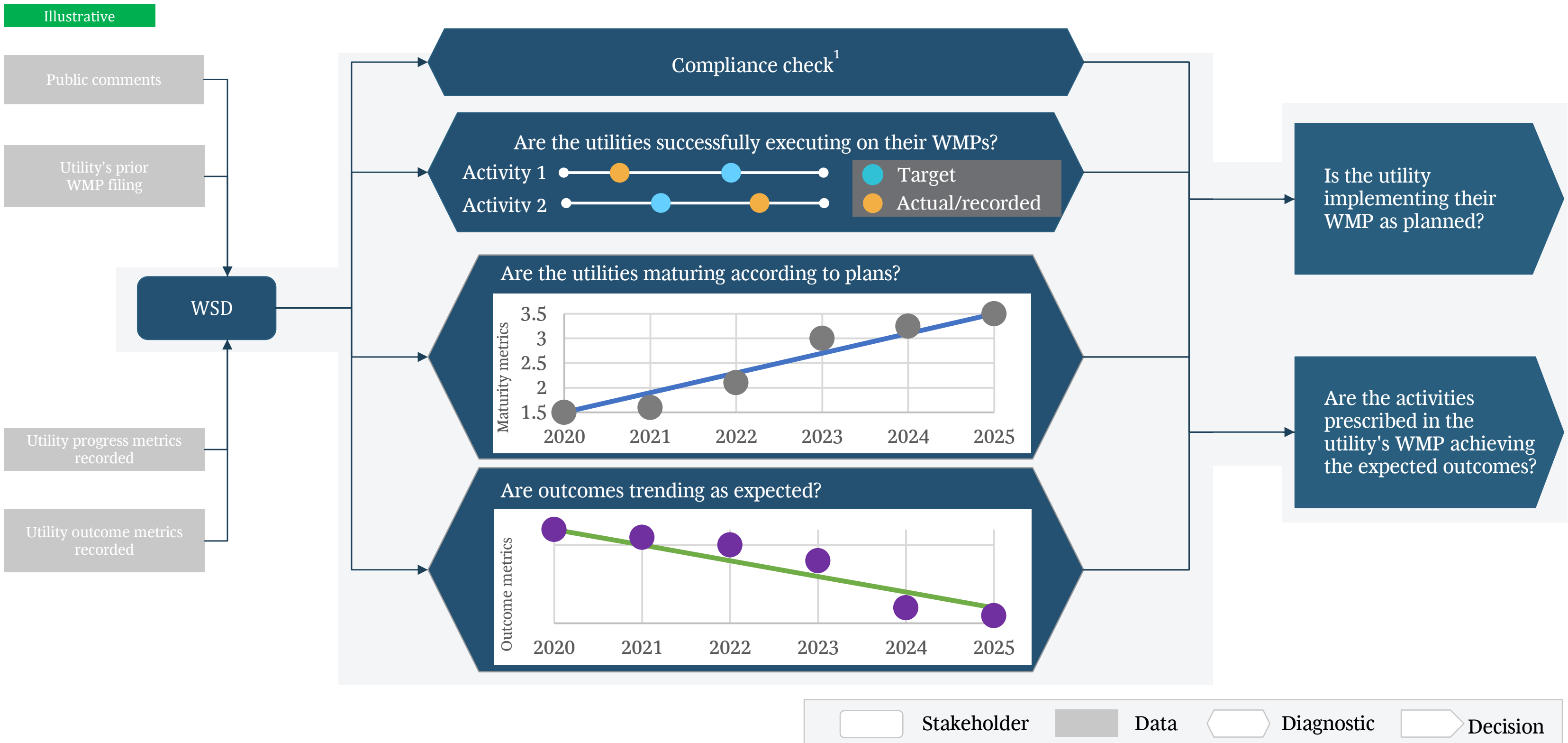
   As with the original maturity survey in the 2020 WMP review, this diagnostic can be automated and standardized.

4. Are the outcomes trending as expected?

   This diagnostic can be data-driven, as the WSD could utilize leading metrics of utility wildfire risk that the utilities can affect, which were requested in the 2019 guidelines (e.g., near-miss incidents), as a proxy that can be calculated even outside of wildfire season.

The WSD could use the first three diagnostics to determine whether the utility is undertaken activities in line with their WMP. The fourth diagnostic can be used to review the WMPs themselves – to determine, for example, whether they were sufficiently ambitious to achieve the WSD's overall utility wildfire mitigation objectives.

Figure 18: Illustrative process flow for utility activity monitoring



1. Are the utilities complying with applicable regulations?

3.3 Long-term opportunities

3.3.1 Potential actions

In the longer-term, the WSD strives to utilize the full extent of the data strategy, efficiently and effectively collecting, ingesting, validating, and storing data in a platform that can support complex analyses while meeting specific needs of individual stakeholders. The WMP review and annual progress updates will be data-supported processes, with benchmarks and metrics enabling decision makers. Evaluations can be applied more consistently and objectively, saving review time for expert staff. New diagnostic methods, developed internally and by universities and the private sector, can be tested using historical data, logically organized and easily accessible.

State and federal agencies, communities, and private landowners can also partner with the WSD in developing their data strategy for utility wildfire mitigation. In the long-term, these stakeholders also need to assess the level of utility-related wildfire risk and allocate resources towards utility wildfire mitigation, and will be able to adopt similar data-driven evaluation and planning developed in partnership with the WSD. For example, other agencies could transform their planning and oversight activities by leveraging the WSD's data strategy, either directly through their use of WSD tools, or indirectly, by fashioning their own data strategy in its image.

As the state's utility wildfire mitigation assessment and response infrastructure evolves, the WSD's data strategy will be integrated with the broader state emergency management infrastructure. For example, the planned Wildfire Forecast and Threat Intelligence Integration Center, to be built out under the leadership of Cal OES,[15] may take on some of the assessment responsibilities currently anticipated for the WSD data strategy.

3.3.2 Example case study: data strategy implementation at the FAA

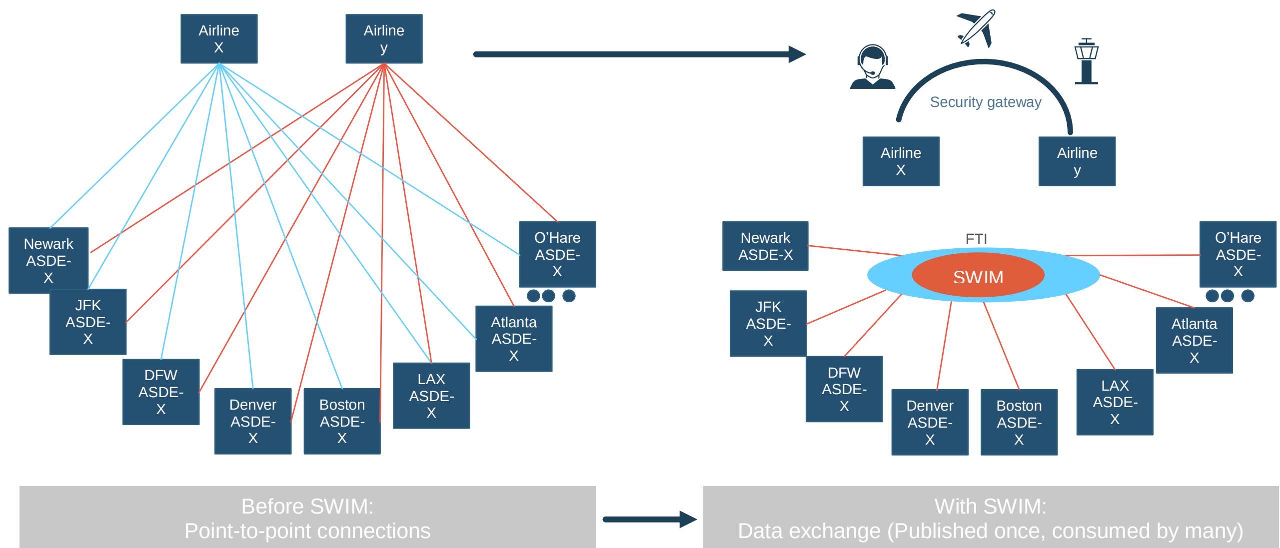
Other government agencies have utilized data strategies to address similarly complex regulatory challenges. For example, the Federal Aviation Administration (FAA) reshaped its national air traffic control system, in response to safety, economic, and passenger satisfaction concerns with a manual data flow and reactive decision-making process.

Previously, air traffic control was not data-driven. Planes could take off, even though arrival airports could not handle their landing. Such an approach was expensive (in terms of wasted fuel), and less safe (more passenger time spent onboard, where they could not receive medical attention in an emergency). Airlines brought to the FAA's attention incidents where weather disruptions were known well in advance, but the FAA did nothing to adjust traffic guidance.

To solve for data sharing challenge, the FAA launched the System Wide Information Management (SWIM) Program to consolidate antiquated data-sharing processes and to support the Next Generation Air Transportation System (NextGen), an analytical and decision-making platform. The SWIM system is illustrated in Figure 19 below.

[15] Senate Bill 209, (Dodd, Chapter 405, Statutes of 2019), (SB 209).

Figure 19: Example of data strategy implementation at FAA



Source: Federal Aviation Administration. *Federal Aviation Administration System Wide Information Management (SWIM) – Program Overview & Status*. September 24, 2015.

In developing SWIM, the FAA had four types of partners:

- Industry: Responsible for advising on technology and implementation
- Airlines: Provided perspective on needs and challenges
- R&D: Developed prototypes
- International peers: Coordinates planning with fellow national airspace regulators

The SWIM group meets monthly to bring issues to the FAA's attention, and the FAA can bring in relevant experts from within its ranks for storyboarding and prototyping. One innovation was a time-based metering approach – anticipating constraints at arrival airports, and holding planes at departure gates, where passengers were safer and could be attended to, instead of creating a traffic jam or forcing diversions.

FAA is now able to anticipate weather events and communicate airspace restrictions (e.g., how many planes allowed to land) 24 hours in advance, giving airlines time to re-route passengers, and relieving local air traffic controllers of having to make such decisions in real-time. Modernizing national air traffic control through data-driven optimization has yielded nearly $5 billion in passenger and airline benefits through efficiencies, as well as safety improvements in areas with limited radar coverage.

3.3.3 Long-term use case

WMP Review: Advanced

Longer-term, this data strategy – along with improved data availability – can enable the WSD to review WMP submissions and determine whether utilities have allocated resources optimally to decrease utility-related wildfire risk, in the highest need areas, by potentially estimating:

- **Residual risk level by location:** Baseline utility wildfire risk level in a particular location (assuming no mitigation measures)
- **Risk reduction impact by measure in each location:** Degree to which a given measure lowers utility wildfire risk, multiplied by the number of years the measure is effective
- **Risk-spend efficiency (RSE) by measure in each location:** Ratio of risk reduction efficacy to the cost of such measure

To do so, the WSD will need to be able to access and utilize a rich, well-organized data set that includes risk drivers (e.g., climate, asset conditions, and maintenance practices), historical correlations with wildfire ignition related to utility infrastructure and propagation, and the realized impact and cost-effectiveness of different mitigation measures. This will require significant improvements from utilities to the availability and access related to existing utility infrastructure.

Calculating the risk reduction impact and RSE, per location per measure, yields three benefits to the WSD, utilities, and broader wildfire community:

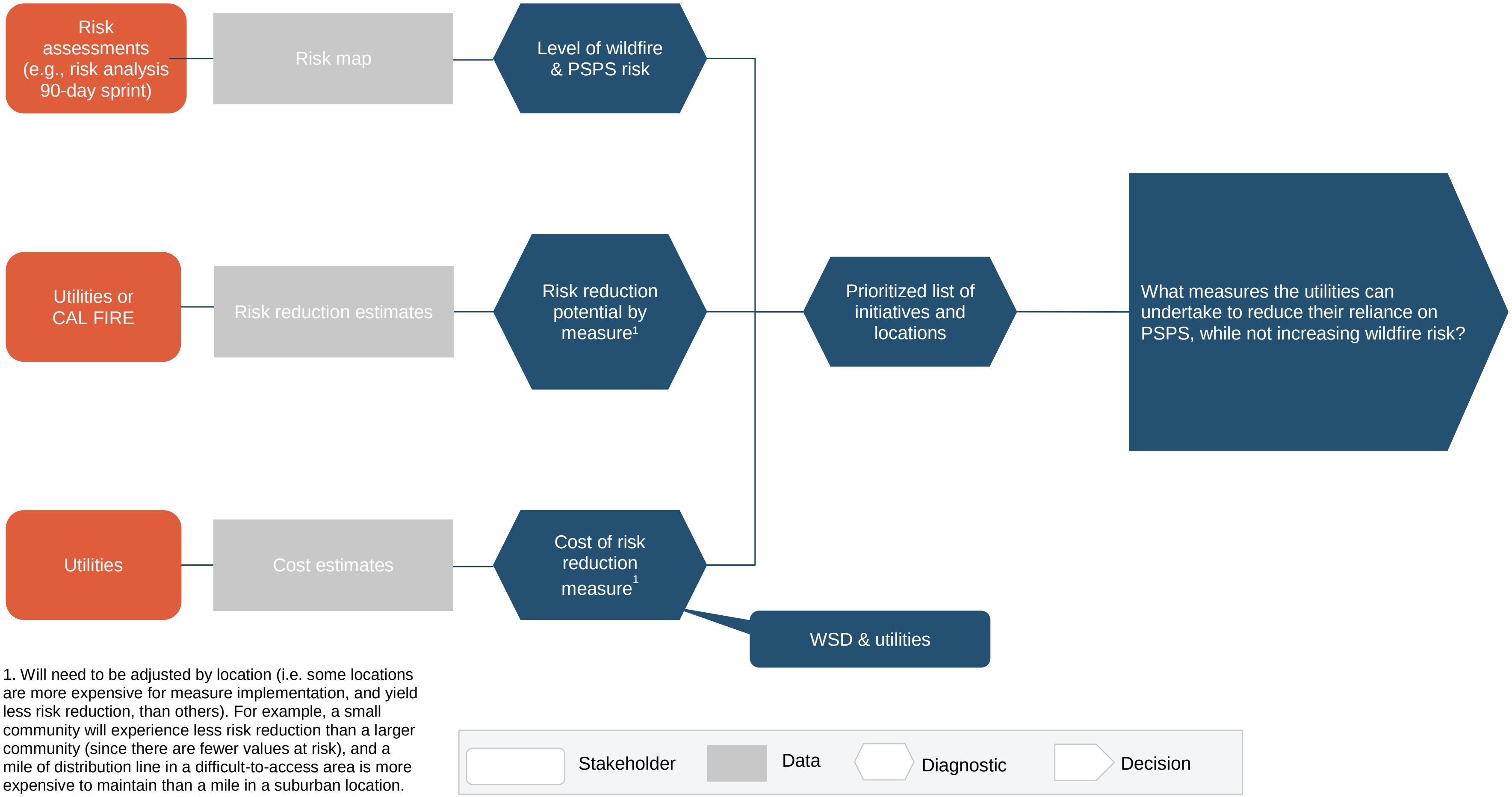
1. **Prioritization**
   The combination of efficacy and RSE provides a transparent and quantified prioritization schematic, and allows utilities to consider resources that partners (e.g., Fire Safe Council volunteers) could contribute. In addition, such diagnostics could be utilized to identify constraints,[16] as well as synergies and economies of scale (e.g., coordinated procurement of difficult-to-obtain equipment) that could affect measures' RSE.

2. **Optimization**
   Given budget, workforce, and other constraints, identify the measures and locations that maximizes utility-related wildfire risk reduction.[17] With this optimization, the WSD could validate that utilities' planned spending will yield a reduction in wildfire risk, that the utilities are focused on the highest-priority locations, and that they are investing their resources in the most cost-effective manner. Beyond its utility oversight, the WSD could utilize the optimization framework to lead a broader statewide conversation about resource allocation. An illustrative process flow for resource allocation review is shown in Figure 20.

[16] For example, some easements do not have sufficient underground space for burying electrical lines. Source: Lawrence Berkeley National Laboratory. *A Method to Estimate the Costs and Benefits of Undergrounding Electricity Transmission and Distribution Lines.* October 2016. http://eta-publications.lbl.gov/sites/default/files/lbnl-1006394_pre-publication.pdf.

[17] The lack of such a methodology by the major utilities was one of the major findings by the CPUC's Safety and Enforcement Division (SED) in its review of S-MAP filings. California Public Utilities Commission. *Safety and Enforcement Division Evaluation Report on the Risk Evaluation Models and Risk-based Decision Frameworks in A.15-05-002, et al.* March 21, 2016. http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10483.

Figure 20: Illustrative process flow for resource allocation review



1. Will need to be adjusted by location (i.e. some locations are more expensive for measure implementation, and yield less risk reduction, than others). For example, a small community will experience less risk reduction than a larger community (since there are fewer values at risk), and a mile of distribution line in a difficult-to-access area is more expensive to maintain than a mile in a suburban location.

3. **Technology assessment**

The calculations could be utilized to evaluate the market for new technologies, as well as the value they deliver. Specifically, the WSD could identify locations where the new technology could greater impact and/or RSE than existing solutions, structure proof-of-concept with industry and university partners, and work with the California Energy Commission (CEC)[18] to fund early commercialization. For example, the WSD could:

- Serve the community created by the March 2019 Wildfire Technology Innovation Summit[19] by establishing a portal for software developers to test new applications (while maintaining the security and confidentiality of the underlying data).
- Identify opportunities to use biomass-fueled generation to improve the economics of fuel treatments. Specifically, the WSD could determine the feasibility of installing wood-fueled boilers or cogeneration at hospitals[20] or other energy-intensive facilities located near areas requiring thinning and clearing, in order to lower the cost to transport for disposal, and to generate additional revenue.
- Lead the design and costing of mini-grids serving remote communities, drawing upon work by Lawrence Berkeley National Laboratory[21] on simplifying the design of systems serving areas without established electrical grids.
- Promote microgrids powered primarily by centralized renewable resources, using as an example SDG&E's Borrego Springs microgrid, serving a 2,800-resident town at the end of a single 50-mile radial transmission line. In particular, the microgrid was effective at integrating / dispatching multiple generation resources, the largest of which (a 26 MW solar plant) was intermittent.[22]

In addition, a rich data set could be used by the WSD and utilities to inform resource planning and rate design. For example, if the WSD determined that no adequate or cost-effective measure existed to mitigate a circuit's wildfire risk, rather than either allowing the utility to spend inefficiently or to bear the extraordinary risk, they could recognize the need to use PSPS on that circuit. At the same time, interconnected customers could be encouraged to adopt local power solutions (e.g., backup generation, solar paired with energy storage, owned either by the consumer, the utility, or a third party) to allow communities to withstand frequent de-energizations.

Four options are among those available to the WSD for directly incentivizing local investments in such areas:

[18] The CEC (under CPUC oversight) administers grants through its Electric Program Investment Charge (EPIC) program, which is funded by a mandated utility charge. Source: California Energy Commission. "Electric Program Investment Charge Program – EPIC." https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program.

[19] CPUC. *Wildfire Technology Innovation Summit*. March 20-21, 2019. https://firetechsummit.cpuc.ca.gov/.

[20] For example: Vermont Department of Forests, Parks and Recreation. *North Country Hospital Biomass Combined Heat and Power Demonstration Project*. July 2007. https://archive.epa.gov/region1/healthcare/web/pdf/appendixa.pdf; Gundersen Health System. *Biomass boiler a key part of Gundersen energy independence goal*. https://www.gundersenenvision.org/app/files/public/5317/envision-case-studies-biomass-boiler-chp-project.pdf.

[21] Lawrence Berkeley National Laboratory. *Rural electrification and capacity expansion with an integrated modeling approach*. January 2018. http://eta-publications.lbl.gov/sites/default/files/pdf_11.pdf.

[22] CEC. *Borrego Springs: California's First Renewable Energy-Based Community Microgrid*. February 2019. https://ww2.energy.ca.gov/2019publications/CEC-500-2019-013/CEC-500-2019-013.pdf.

- The WSD could design a subsidy program, utilizing as a template the Self-Generation Incentive Program[23] to offset the cost of specific locations and types of power generation and management resources (reflecting the balance between wildfire, reliability, sustainability, and affordability priorities).
- Through rate design the WSD and utilities could recognize the reliability (and wildfire risk reduction) benefit of local solutions, either by reimbursing for services (similar to payments for ancillary services, such as voltage control) or compensating customers for the avoided mitigation measures.[24]
- The WSD could allow utilities to increase their distribution charges to customers located in such areas, making grid-connected power more expensive relative to the cost of procuring local generation.
- The WSD could lower reliability requirements for such circuits, reflecting the need for PSPS, and creating a disincentive for customers to remain without a backup power source.

By partnering with county and state actors, the WSD could unlock additional types of incentives, including Property-Assessed Clean Energy (PACE) Financing[25] and low-interest loans.[26]

3.3.4 Long-term coordination and integration with other state agencies

The WSD must begin to lay the groundwork today to gain access to more robust data and analytics capabilities in the longer-term, whether by acquiring talent directly or forming partnerships to leverage existing capabilities. A comprehensive data strategy builds on early foundations, such as common data dictionary and standardized processes for data sharing and risk analysis, creating a platform to support new technologies and diagnostic methods. Advances in data-gathering and analytics have the potential to change how decision-makers receive intelligence, coordinate activity with partners, and provide greater transparency to regulators. It then has the potential to better inform policy and regulatory decisions in the longer-term. Furthermore, more advanced data analytics capabilities can also enable more, detailed data to be available to public stakeholders. Specific to the WSD advanced data can support advanced risk assessments, investment decisions, and resource allocations which would benefit from data-driven scenario planning and optimization. The WSD needs sufficient data fluency in these areas in order to regulate the utilities appropriately.

In order to support and regulate the intelligence derived from advanced analytics, additional data must also be collected by utilities and others over time, at the cadence, accuracy, and quality that the analytics require. Where needed, new metrics, such as a Northern California equivalent of the Santa Ana Wildfire Threat Index (SAWTI), for instance, should be developed to standardize codification of type and degree of risk, using a well-publicized reference point. Additionally, linking data to a central geographic information system (GIS) would allow a range of stakeholders to understand the level and nature of the utility-related wildfire threat, e.g., by

[23] The Self-Generation Incentive Program (https://www.cpuc.ca.gov/sgip/) provides incentives for customer-sited distributed renewable energy systems, with allocations for energy storage technology and siting in low-income communities (many of which are also in High Fire Threat Districts https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/lowincomemapfull.htm)

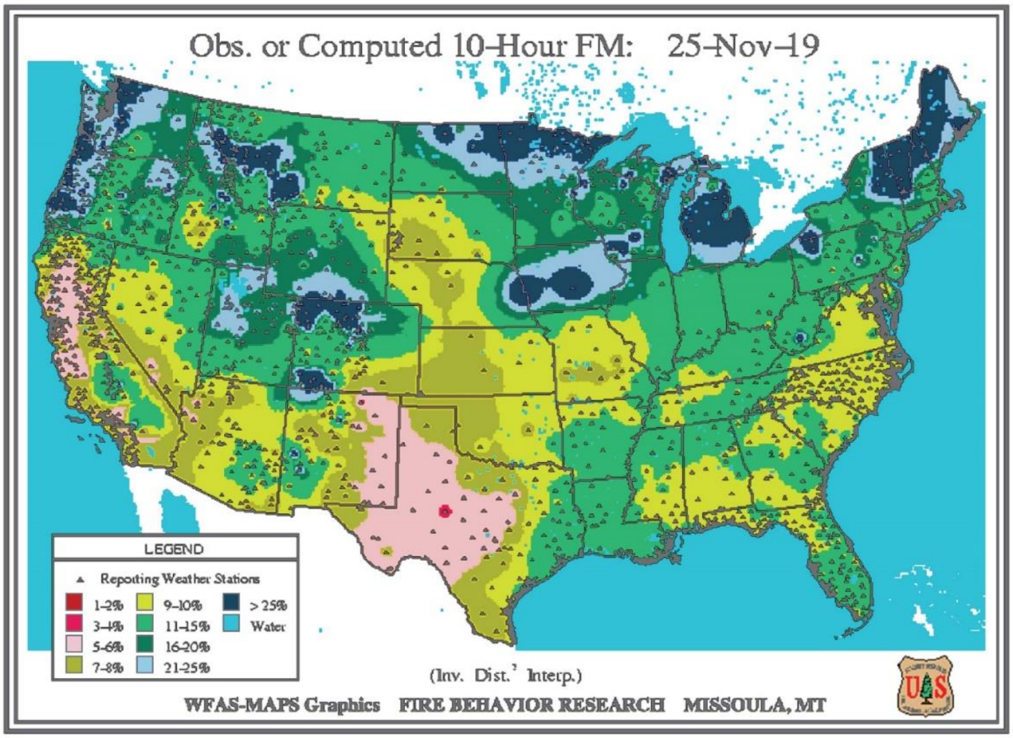
[24] See discussion of rate design in: Lawrence Berkeley National Laboratory. *Distribution System Pricing with Distributed Energy Resources.* May 2016. https://emp.lbl.gov/sites/all/files/feur_4_20160518_fin-links2.pdf.

[25] See United States Department of Energy. *Property Assessed Clean Energy Programs*. https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs.

[26] See, for example: CEC. *Energy Conservation Assistance Act (ECAA)*. https://www.energy.ca.gov/programs-and-topics/programs/energy-conservation-assistance-act.

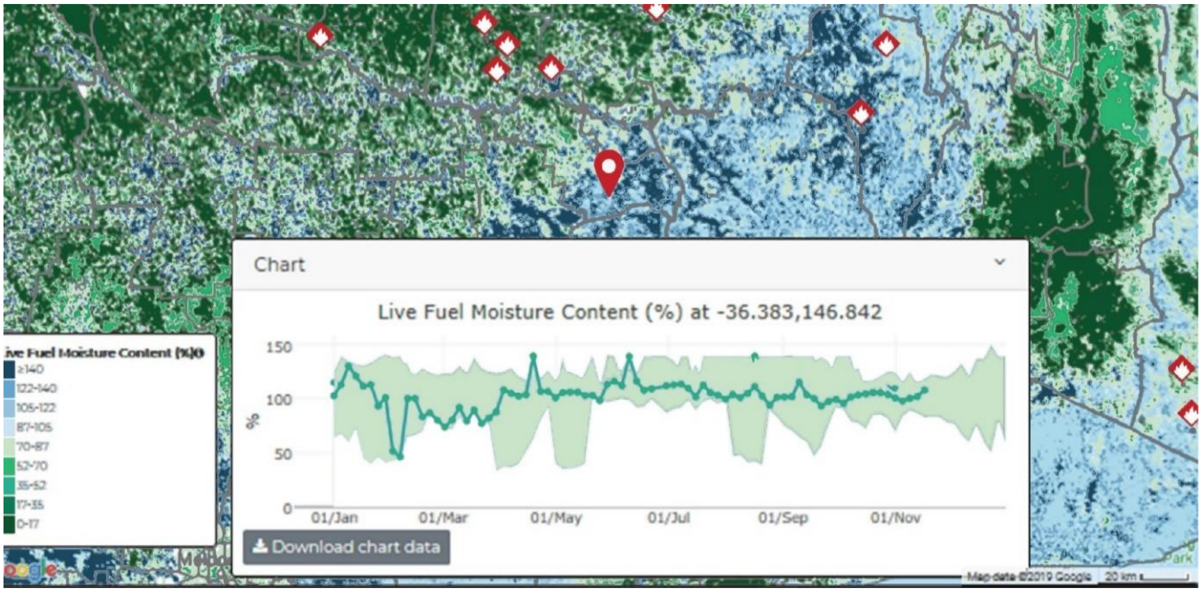
comparing relevant wildfire risk indicators across geographies (as shown in Figures 21a and 21b for fuel moisture content for the U.S. and Australia respectively). The WSD can help facilitate standard data collection and information sharing between the utilities and other wildfire mitigation stakeholders such as CAL FIRE and Cal OES.

Figure 21a: Fuel moisture content of the United States displayed in a static image with low geographic resolution



Source: USFS. *US Forest Service Wildland Fire Assessment System Dead Fuel Moisture Content*. http://www.wfas.net/index.php/dead-fuel-moisture-moisture--drought-38 (accessed November 25, 2019).

Figure 21b: Fuel moisture content of Australia displayed in a GIS-enabled online application, with km-scale granularity, overlays of historical content, and the locations of current fires



Source: Bushfire & Natural Hazards CRC. *Australian Flammability Monitoring System*. http://www.wenfo.org/afms (accessed November 25, 2019).

Finally, in the long-term, WSD and utilities' risk reduction activities will benefit from data from external non-utility stakeholders and incorporation of fire science expertise (e.g., from universities and research institutions). Collaborating with California's premier research institutions, including the national laboratories, could strengthen the technical foundations of the WSD's diagnostics and intelligence generation, and, collectively, establish the state as a global leader in responding to a growing yet difficult-to-quantify risk.

4 Conclusion

This utility wildfire mitigation data strategy can enable the WSD to transform how the organization uses data to oversee and regulate utility wildfire policies and procedures. As shown below in Figure 22, the data strategy empowers the WSD overcome the data-related pain points it faces today in carrying out its oversight and regulatory responsibilities. By executing this strategy today's manual review and decision-making processes can be improved by rigorous, data-enabled insight.

Figure 22: Addressing existing pain points with WSD's utility wildfire mitigation data strategy

Today Pain points	Example	Future Elements of the data strategy
Limited use of data	Fuel moisture content data sampled using different methods	Data dictionary defines requirements for data collection
Lack of standardization and consistency	Each utility uses its own Fire Potential Index	WSD can establish standard diagnostic procedures as benchmarks
Subjectivity	WSD decisions made by subject-matter experts	Playbook to document how data and diagnostics should be utilized
Lack of transparency	WSD often does not have visibility into the data and diagnostics informing PSPS decisions	Data access protocols allow WSD to retrieve (and properly handle) sensitive data
Limited stakeholder participation	Utilities do not involve full range of stakeholders in long-term planning	Reporting applications can be designed for use by stakeholders with limited technical resources

A data strategy offers the opportunity to substantially transform this process by creating a platform of standardized, coordinated data, upon which the WSD, other agencies, or external stakeholders could run their analytics and generate insights useful for their decision-making. A data platform representing the 'single source of truth' for relevant utility-related wildfire data creates the foundation for mutual understanding and collaboration, promoting cross-pollination of best practices across stakeholders and encouraging continuous learning and improvement.

By taking advantage of the opportunity created by the 2020 WMP review process to begin building the foundations of a robust data strategy, California can position itself to become a leader in the state and global utility wildfire mitigation communities.